

TITLE: "INVESTIGATION OF FLY ASH AND ACTIVATED CARBON OBTAINED FROM PULVERIZED COAL BOILERS"

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1. ABSTRACT

OBJECTIVES

One of the techniques for Hg capture in coal-fired boilers involves injection of activated carbon (AC) into the boiler downstream of the air preheater. Hg is adsorbed onto the AC particles and fly ash, which are then both removed in an electrostatic precipitator or baghouse. While field trials with AC injection have demonstrated the ability to remove significant fractions of the Hg at some units, there are also problems in using AC for Hg capture. Activated carbon is relatively expensive, leading to very high projected costs for Hg capture. The feed rates of AC required for Hg control will also result in significant increases in carbon content of the ash, which has raised concerns that widespread use of AC for Hg capture will eliminate concrete as a viable market for reuse of ash, thereby greatly reducing the percentage of coal ash which can be reused.

Published data from field tests of coal-fired boilers equipped with SCR reactors for NO_x control show the presence of the SCR increases the percentage of gas phase Hg which is removed with the fly ash. This raises questions about the effects of SCR systems on fly ash properties and on the specific properties of the ash that result in greater potential for Hg capture.

This project addresses the issues of Hg on activated carbon and on fly ash from a materials re-use point of view. It also addresses the possible connection between SCR reactors, fly ash properties and Hg capture. The project will determine the feasibility of separating AC from fly ash in a fluidized bed and of regenerating the separated AC by heating the AC to elevated temperatures in a fluidized bed. Finally, samples of fly ash from power plants with SCR reactors will be analyzed to determine the effect of SCR on the ash. These analyses will also determine the properties of ash which are important for Hg capture.

ACCOMPLISHMENTS TO DATE

Removal of Mercury from Activated Carbon

Experiments are being performed in a fluidized bed to determine the feasibility of separating the activated carbon and fly ash based on differences in particle density between the two materials. In addition, equipment is being fabricated for a second round of experiments to determine the potential for removing Hg from spent activated carbon, using a heated bubbling fluidized bed. The mercury removal experiments will be performed in a 6 inch diameter batch fluidized bed equipped with in-bed electrical heating elements to raise the temperature of the bed material to elevated levels. The experiments will determine the temperatures required to drive off the mercury, the

percentage of Hg removal which can be achieved, and the solids residence time needed to remove the Hg. Electron microscopy and porosity measurements will determine if the activated carbon is degraded as a result of the Hg removal process.

Effect of SCR on Fly Ash Properties

Samples of fly ash have been obtained from a boiler equipped with an SCR reactor. Transmission electron microscopy (TEM) studies of the ash are underway in an effort to determine if, as a consequence of passing through the reactor, the surface properties of the ash are altered in a way which promotes mercury capture. Other TEM measurements will focus on the unburned carbon in the fly ash, in an effort to determine which carbon phases are more likely to capture Hg.

FUTURE WORK

- Continue the fluidized bed experiments on separating activated carbon from fly ash.
- Carry out experiments on desorption of Hg from activated carbon.
- Continue the SEM and TEM studies of fly ash and activated carbon.

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